MISSION STATEMENT

BASIC ENTOMOLOGY TRAINING IN BURUNDI BUJUMBURA, JUNE 18-30, 2012

By
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According to the Agreement Memorandum concluded on March 15, 2012 with Research Triangle Institute (RTI), we conducted a consultative role at the National Integrated Programme against Malaria from June 16 to July 3, 2012 in Bujumbura, Burundi. As soon as we reached Bujumbura on June 17, we were led to our hotel (Safari Gate Hotel). The terms of reference of the mission are annexed.

TRAINING PROGRESS

1. Site visit and installation of the equipment needed for the practical planned for the training.

The training began on June 18 in the morning by a courtesy visit to the USAID in the presence of Mrs. MDAYISHIMIYE Anatolie. During this visit, we were welcomed by Dr. Lieven MSABIYUMVA, with whom we had fruitful discussions about the purpose and the expectations of the training. Just before noon, we visited the new Entomology laboratory of the National Integrated Programme against Malaria (PNILP). The purpose of the visit is to examine the configuration of the building and make recommendations for possible improvements and propose the necessary steps to make it functional.

Entomological research is the weak link of the research activities supporting activities for malaria control in Burundi. The Vector Control Unit of the PNILP has a small laboratory in the building that houses the PNILP with a motivated technical staff who had already been trained in entomology in the past but had not had the opportunity to work in the field due to the absence of a specialist in entomology and on-site technical support. Indeed RTI has provided entomology equipment to PNILP, but this equipment is not used. Moreover, much

of the equipment was still in its packaging during our visit. So, we had to use the afternoon to set up the necessary equipment for the practical planned for the training.

2. Opening day of the training

The official start of the training took place on Tuesday, June 19, 2012 at 9 am at the National Institute of Public Health. Mrs. MDAYISHIMIYE Anatolie, Head of the Vector Control Unit of the PNILP, representing the Director of the National Integrated Programme against Malaria who was on mission, thanked the United States Agency for International Development (USAID) which provides technical and financial supports to African countries for the implementation of malaria and other vector borne diseases control activities and the RTI for initiating and funding the training. For the representative of the Director of the NMCP, entomological research and vector control are the poor relations of malaria research and the methods used to fight against this disease in Burundi. Consequently, very few data are available today in the field of entomology in Burundi. The training organized by the RTI is then a great opportunity to train technicians about basic entomology to support the National Integrated Programme for the Fight against Malaria for monitoring the dynamics of malaria vectors and the susceptibility of the vectors to insecticides in Burundi. Those are the words spoken by the representative of the Director of the PNILP, Mrs. MDAYISHIMIYE Anatolie, to launch the training after having wished the RTI consultant a wonderful stay in Burundi

3. Implementation of the training

After the start ceremony, a pre-test which aims at assessing the level of each participant in basic malaria entomology was organized as the training participants do not have the same profile.

The training took place at the National Institute of Public Health on four points: a theoretical section, a practical section on the field and in the laboratory, the stock of entomology equipment available at the PNILP and a discussion with the participants on arrangements to make so that the entomology laboratory of Gihanga could function and finally, a pre-test/post-test evaluation.

4. Theorical section

This section began on Tuesday, June 19 by the presentation of the planning of the two-week training and an introduction to medical entomology after a review of the context and expectations of the training. The points of the training planning were as follows:

- Identification of malaria vectors (mosquitoes morphological identification);

- Techniques for sampling larvae and adult mosquitoes;
- Mosquitoes breeding in the laboratory;
- Completion of susceptibility testing and interpretation of results;
- Performing effectiveness tests;
- Malaria stratification;
- Incrimination of malaria vector (density calculation from two types of sampling: night human bait catch inside and outside houses and indoor residual spraying of insecticide ... etc.);
- Controling malaria vectors;
- Transport and conservation of mosquito samples.

The introduction to malaria entomology focused on the description of the transmission cycle of malaria, the description of the mosquito's life cycle in relation to the transmission as well as the purpose and the role of entomological studies regarding malaria control. All aspects in the planning were largely dealt with during the first week. The courses were mainly based on PowerPoint presentations. At any time, learners could stop the consultant for clarification. Demonstration works were performed after some courses to help the trainees get the message better. The WHO document entitled 'Malaria entomology and vector control' (WHO/CDS/CPE/2002. 18 Rev. 1, Part 1, French version, Temporary Edition, July 2003) was elaborated as a booklet and distributed to the trainees.

5. Practical sessions

All the basic techniques of medical entomology were reviewed. They include:

5.1. Mosquito larvae and adults sampling techniques

A larval survey was conducted on Wednesday, June 20 in a vegetable area in the city of Bujumbura and in other venues on the outskirts of Buterere Commune (Kiyange and Mubone). The majority of water points encountered were very good shelters, but mostly negative. Very few larvae of *Anopheles gambiae* and Culex were collected. The few larvae collected were returned to the NIPH for their exploitation. The Anopheles larvae were separated from those of Culex. The pupae of Anopheles were sorted and caged. The introduction to larvae rearing then started. Participants learned to feed the larvae contained in the tanks, to give the amount of food it takes to avoid an overload in the trays, to use pipettes to sort the nymphs, to put the nymphs in cages in the presence of cotton soaked with fruit juice.

On Friday, June 22, another session of recognition of mosquito larvae was conducted on the field. During this session, larvae of *An. gambiae* were collected in Gihanga in Bubanza province, not far from the new entomology laboratory. At the second outgoing, larvae of *An. gambiae* and Culex were collected. These larvae were brought to the INSP for morphological identification and breeding. The nymphs were sorted and caged. The other larvae from first to fourth stage were kept in the rearing tanks. According to our planning, the adults obtained from these larvae will be used for susceptibility testing with the WHO tubes. On the weekend, a team was appointed to monitor the breeding (nymphs sorting, breeding water renewal, larvae and adults feeding). The introduction to the breeding of mosquitoes occurred at INSP which happens not to be the ideal place for mosquito breeding. Because of this situation, instructions were given so that the cages could not be attacked by ants. The temperature of the room and the hygrometry are factors to follow up for a good mosquito breeding.
On June 26, a catch by indoor residual spraying of non-residual insecticide (spray catch) was conducted early in the morning by the trainees at Nyarumanga, a rice growing area on the outskirts of Bujumbura. A total of 10 rooms were prospected. During the catches, the number of people who slept the night before as well as the presence or absence of mosquito net were noted. The mosquitoes collected were identified, some locally and the others at INSP. The Anophelines were separated from the Culicine. The *An. gambiae* were recognized. Then males were separated from females. Mosquitoes were separated into four groups: the not fed, the satiated, the semi-gravid and the gravid. The mosquito density per hut and the biting rate (number of bites per man per night) were estimated. The average density of people per hut and the average number of nets per household were calculated. Only four Anopheles (all of them being *Anopheles gambiae*) out of the 57 mosquitoes collected after indoor spraying of insecticide in houses were identified. Despite the presence of nets in most of the houses, the majority of the mosquitoes collected were found with relatively fresh blood in the abdomen. We used the number of satiated and semi-gravid mosquitoes as well as the number of people who slept the night before in the huts to estimate the biting rate.
On Wednesday, June 27, a night catch was conducted in the yard of the PNILP. The participants in the training were bait-catchers. From 8 pm to 10 pm, lots of mosquitoes were captured by all trainees (unfortunately there were many Culex and just one Anopheles). This session showed us that the technique of Anopheles sampling from human bait was mastered. The mosquitoes caught at night and those collected after indoor spraying were brought back to the INSP for morphological identification and conservation.

5.2. Morphological identification of mosquitoes

The trainees learnt how to make the difference between Anopheles and the other Culicidae, morphologically, to the naked eye and under the microscope. The recognition of mosquitoes at the sub-families level (Anophelinae/Anopheles, Culicinae/Culex) seems well-mastered. This was the bane of some of the trainees. We had to practise everyday to succeed in making them understand. At the end of the training, the trainees finally mastered the recognition..

5.3. Completion of susceptibility testing and interpretation of results

Several demonstrations of the susceptibility testings were made by the consultant before letting the trainees perform. During the testing, a stress was put on the conditions required for testing (especially temperature and humidity conditions) and what to avoid during manipulations in order not to traumatize the mosquitoes. At the beginning, it was difficult for the trainees to transfer mosquitoes from the cage into the WHO tubes. But after two or three practices, the process was acquired. In the absence of a sufficient number of mosquitoes due to the season, the trainees performed the insecticide testing with the Culex females that they captured. They used paper impregnated with permethrin 0.75% and deltamethrin 0.05% for the testing. Then they learned how to record the results on a sheet that was giving to them and interpret the data (sensitive or resistant population and suspecting resistance).

5.4. Performing cone bioassay tests

This part was nearly not going to be dealt with during the training. As a matter of fact, there was no bioassay kit with cones at the PNILP. We had to send a message to the CREC in Cotonou to be finally sent the cones and other accessories in emergency by Express Mail. A net was cut and the pieces were used for testing. Here also, we longly insisted on the procedures and conditions for carrying the testing professionally.

5.5. Labeling and conservation of mosquito samples

This section was considered very important because one of the roles of the new technicians in medical entomology is transporting mosquitoes from the field to the PNILP after capture. It is important to mention that mislabeling mixes up the samples, creating confusion and also making them lose their origin. Besides, poor preservation of the samples destroys the mosquitoes. Thus, false or unusable results are obtained after treatment. Strict instructions were given to the trainees about this.

5.6. Breeding mosquitoes in the laboratory

The insectary of the Entomology Laboratory of the PNILP is not functional yet. However, we created a makeshift insectary which allowed us to raise the mosquito larvae we collected. Yet, for a professional breeding, we insisted on mosquito breeding conditions: temperature and humidity conditions, larvae and adults feeding, nymphs sorting... etc.

6. Control of the equipment given to the PNILP by RTI

On Thursday, June 28, 2012, we controlled the equipment acquired by RTI and given to PNILP. The purpose of the control was to make sure all equipment purchased had been received by the PNILP and each material stored in appropriate conditions. The control was conducted in the presence of the staff of the Unit of Vector control of the PNILP. It was noticed from this control that the whole equipment on the list we were given by RTI was effectively at the PNILP. During the visit, we were surprised to find that some materials we longly talked about during the formation were present. This is the case of thermo-hygrometers. A thermo-hygrometer is a device for measuring the physicochemical parameters of larvae breeding sites. There were also lots of microscopes and stereomicroscopes (8 of each). Due to lack of rooms at the PNILP, the whole equipment was kept in its packaging. Nevertheless, arrangements are being taking to transfer this equipment to the entomology laboratory of Gihanga.

7. Evaluation

Two evaluations were organized. The one was on the recognition of mosquitoes and the other on a pre-test and a post-test. The purpose of the assessment was to check to what level the courses had been assimilated by the trainees and to what level the information had been transferred to them. Actually, this was not to sanction them with assessment scores at all.

Result of the pre-test:

Number of participants: 11

Number of participants with the average: 10

Group average: 12.4/21

Result of the post-test:

Number of participants: 11

Number of participants with the average: 11

Group average: 18.8/21

We availed ourselves of the last session of the training to give the results and publicly congratulate the trainees for the progress achieved.

8. Development work at the entomology laboratory of the PNILP

Visiting the entomology laboratory was to examine the configuration of the building and make recommendations for possible improvements. The following adjustments need to be made:

8.1. **Insectary room** "larvae and adults": provide shelves to keep the larval trays and cages for the breeding of mosquitoes, a small draining board equipped with a sink and a water tap for permanent water for various uses. Regarding the compartment for adults, provide a separation for resistant strains and sensitive strains.

8.2. Laboratory room : provide a draining board equipped with a sink and a water tap along one of the walls and stools for technicians.

8.3. Office: Provide a table and chairs for the laboratory supervisor and for his assistant

8.4. About the animals: bring water into the room to clean the animals and take care of them.

9. Discussion with the trainees and recommendations

On Friday, June 29, a discussion about the functioning of the entomology laboratory of the PNILP was initiated. At the end of the discussion, three recommendations were made.

- Keep the collaboration between the National Integrated Program against Malaria and the Entomological Research Center of Cotonou (CREC)
- Train two technicians of the PNILP on specific techniques for identifying mosquitoes, the techniques for the dissection of Anopheles, the techniques for the quality control of treated materials, the ELISA and PCR techniques and data analysis (a thorough three-month training in Africa in an entomological research center)

-Establish collaboration between the PNILP and the research centers as well as the universities of Burundi involved in research in the field of entomology

10. Conclusion

The training was a success. The goals are reached. The trainees received a good basic training. They are now equipped to identify the shelters of Anopheles larvae on the field, collect the larvae, breed them to get adults and perform tests of susceptibility to insecticides, perform the sampling of the adults on human bait and after indoor residual spraying with insecticide, identify mosquitoes at the genus level and transport them under good conditions.

At the end of the training, fruitful discussions led to recommendations for the functioning of the entomology laboratory.

11. Aknowledgement

I would like to thank the PNILP, the USAID and RTI for giving me the opportunity to lead this training. I would also like to thank the Director of National Integrated Program against Malaria and Mrs. MDAYISHIMIYE Anatolia who organized the training for their warm welcome and congratulate them for the excellent organization of this training.
I would also like to thank the trainees with whom I worked in conviviality. They were very enthusiastic learners, hard working, much disciplined and always on time for the courses. I keep a very nice image of them.

Appendix 1

TERMES OF REFERENCES OF THE MISSION

Background

The U.S. Agency for International Development (USAID) offers technical and financial support at the global and country levels for the implementation of malaria and other vector borne disease control activities. Under the Integrated Vector Management Task Order II (IVM 2), the Research Triangle Institute (RTI International) is providing technical assistance resources to institutionalize best practices, conduct operational research and strengthen the management capacities of country programs. The objective is to advance the state of the art of vector control to facilitate and sustain the effective management of disease vectors and reduce local disease burdens. IVM 2 compliments the overall strategy of the President's Malaria Initiative (PMI) in Africa.

As part of the above mandate, the project is supporting the development national capacities in USAID focus countries for entomological monitoring and surveillance to support vector control implementation. Activities include conducting targeted training and establishing insectaries and entomology laboratories and development of national vector surveillance schemes. As part of the 2012 PMI support to Burundi, the IVM project will organized a 2-week basic entomology training course at the end of June 2012 for selected technicians of the national malaria control program (Programme National Integre De Lutte Contre Le Paludism - PNLP). The trained technicians will ensure proper functioning of the newly established insectary[1] and facilitate the initiation of entomological monitoring by the PNLP. The training will cover the following areas:

- Basic malaria eco-epidemiology- including role of vector(s), primary interventions
- Species identification (morphological)
- Adult and larval sampling techniques
- Transmission indices (pyrethrum catches for density assessments, landing catches –outdoor/indoors etc.)
- Fundamentals of laboratory rearing of mosquitoes
- Wall bio-assays on insecticide decay rates and knock down assessments on LLINs
- Vector susceptibility evaluations
- Preparations, labeling and storage of vector samples
- Basics of insectary management

Purpose of STTA

Dr Martin Akogbeto will be engaged as consultant 18 June – 3 July 2012, to support the proposed basic entomology technician training course in Burundi. The Consultant will work closely with the PNLP and the IVM Project Staff. Dr Akogbeto to undertake the following tasks:

- Support the finalization of curriculum and technical content of the training;
- Serve as the expert instructor during the training;
- Provide advisory functions to guide the NMCP as it develops operational plans for entomological monitoring;

Deliverables

- Administer 2-week training of about 10 entomology technicians in Burundi in June and July 2012 and provide a mission report that provides details of the training course.
- Report of the training activity.

Level of Effort

16 full-time work days at 6 days a week.

Appendix 2: Pré-test

FORMATION EN ENTOMOLOGIE DU PALUDISME AU BURUNDI

Répondre aux questions suivantes en soulignant directement sur la feuille la lettre correspondant à la bonne réponse

1. Les moustiques se ressemblent, mais ils sont différents:

a). Vrai ; b). Faux

2. Le paludisme est transmis par un moustique du genre :

a). Aedes b). Anopheles c). Culex

3. Les larves d'anophèle sont reconnaissables dans l'eau par:

a). Position oblique et siphon dirigé dans l'air pour capter l'oxygène

b). Position horizontale à la surface de l'eau

4. Au repos, les anophèles sont reconnaissables par leur position oblique par rapport au support

a). Vrai ; b) Faux

5. Le cycle de développement des larves d'anophèle passe par :

a). 3 stades ; b). 8 stades ; c).4 stades

6. La durée de vie d'un moustique est de :

a) 72 heures ; b) 1 an ; c) 2-3 mois

7. Parmi les gîtes de développement des larves de moustiques ci-dessous, 2 sont ceux préférés par les anophèles :

a). les fûts abandonnés ; b) les canaris et jarres abandonnés ; c) les flaques d'eau ensoleillée ; d) les boîtes de conserve abandonnées ; e) les pneus abandonnés ; d) les bordures des rizières

8. Les moustiques anophèles (Anophelinés) se distinguent des autres moustiques (Culicinés) par :

a). Chez les anophèles, les palpes sont aussi longs que la trompe

b). Chez les autres moustiques (Culicinés) les palpes sont aussi longs que la trompe

9. Les moustiques anophèles préfèrent les petites collections d'eau ensoleillée, propre, limpide :

a). Vrai b) Faux

10. Les moustiques non anophèles, en particulier les moustiques du genre Culex, préfèrent les gîtes sales, pollués

a) Faux b) Vrai

11. Le mâle et la femelle des moustiques se distinguent par :

a). les antennes ; b). la trompe ; c). les palpes

12. Lequel des cycles ci-après se déroule chez le moustique ?

a). cycle érythrocytaire ; b). cycle exo-érythrocytaire ; c). cycle sporogonique

13. Quelle est la localisation de prédilection des sporozoïtes chez l'anophèle ?

a). l'estomac ; b). le foie ; c). les glandes salivaires

14. Les anophèles sont des moustiques qui sont actifs :

a) le jour ; b) la nuit

15. Parmi les 3 méthodes de lutte ci-après, laquelle a un impact direct sur la réduction de la longévité des moustiques ?

a). la lutte anti-larvaire ; b). la pulvérisation intra-domiciliaire d'insecticide; c). l'utilisation des moustiquaires

16. Au Burundi, le paludisme est un problème environnemental qui ne se transmet pas de la même manière d'une région à l'autre, d'où l'existence de plusieurs faciès épidémiologiques.

a). Vrai b). Faux

17. Les moustiques les plus jeunes sont plus aptes à transmettre le paludisme que les moustiques vieux.

a). Vrai ; b) Faux

18. La durée du cycle gonotrophique chez le moustique est la durée qui sépare le repas de sang de la ponte. Cette durée est de :

a). 2-3 jours ; b) 1 heure ; c) 2 semaines

19. Vous trouverez ci-dessous différentes méthodes de capture des moustiques. Cochez la méthode la plus appropriée à l'étude de la transmission du paludisme :

a). capture par les pièges-fenêtres ; b) capture sur homme ; c) capture par aspersion d'insecticide, d) capture par le piège CDC

20. Les moustiquaires PermaNet sont imprégnées avec :

a). la deltaméthrine ; b) la perméthrine ; c) la lambdacyhalothrine, d) la cyperméthrine ; e) l'alpha-cyperméthrine ; f) la cyfluthrine

21. Les moustiquaires Olyset sont imprégnées avec :

a). la deltaméthrine ; b) la perméthrine ; c) la lambdacyhalothrine, d) la cyperméthrine ; e) l'alpha-cyperméthrine ; f) la cyfluthrine

Appendix 3

CURRICULUM: Entomology Technicians Training
(Basic Level)

Purpose of training: The training is aimed at supporting efforts by the national malaria control program (NMCP) to build a critical mass of trained staff at the central and district levels, for entomology surveillance and monitoring to guide malaria vector control interventions. The training will provide entomology technicians with basic knowledge on the role of vector control in malaria control, the biology and control of mosquito vectors, as well as competency in standardized methodologies for the surveillance and monitoring of malaria vectors. The training will focus on hands-on practical experience and ensure that vector monitoring activities in Burundi are uniform and follow the same strict procedures to enhance reliability of results for decision making.

All the areas to be covered by the training are outlined in-depth in the *Manual for Entomology Technicians training* (basic level), drafted by the IVM Project. The draft manual will serve as the basic document guiding the training. The purpose, content of each subject area and associated field activities are as follows.

Topic	Purpose	Associated Activities
Malaria vector control (basic principles)	Vector control is a major element of the Global Malaria Control Strategy of the World Health Organization. It remains the most effective way to prevent malaria transmission. A solid understanding of the interrelationship between the vector, the environment and humans leads to the selection and deployment of the most cost-effective and sustainable intervention(s), either individually or combined— the objective being to achieve the maximum possible reduction or local elimination of the disease.	Field demonstration of main vector control tools (LLINs, residual spraying, larvicides)
Malaria stratification and vector control	Endemnicity of malaria may vary based on geographic zone or climate. The varying levels of malaria transmission (i.e. year-round transmission vs. seasonal transmission vs. epidemic-prone areas), informs intervention strategies that are most appropriate. Stratification also informs the entomological monitoring techniques and the timing of these.	Selection refining of interventions based on transmission and ecological settings
Identifying between anopheline and culicine	Malaria is transmitted by the adult female anopheles mosquito of different species and complexes. A proper identification of the local malaria vector(s) is a necessary step to tailor interventions appropriately in order to maximize the destruction of local disease transmission. This topic will teach participants to: • Know how to identify adult *Anopheles* mosquitoes from other insects; • Differentiate male and female mosquitoes; • Distinguish the female *Anopheles* from other female culicines; • Distinguish between the egg, larva and pupa of *Anopheles*	• Distinguish various stages of anophelines from culicines • Distinguish males from females

Topic		Purpose	Associated Activities
		mosquito from other mosquitoes.	
Vector incrimination and malaria control (determining that an anopheles mosquito is a vector)		There may be more than one anopheline mosquito in a local area. It is important to know which of these local species actually transmits malaria and which is a primary vector and secondary vector. Knowledge on these are important to maximize intervention strategy. Participants will have basic understanding on: • The methods used to determine that a mosquito species is a malaria vector. • Basic entomological indicators of transmission and how to calculate transmission indices. • Some of the factors that affect malaria transmission. Theoretical submission will also cover methods for determining a malaria vector, including determination of: • Contact between the mosquito and humans does occur and that the mosquito feeds on human blood. • The salivary glands of the mosquito contain sporozoites (the stage of the malaria parasite that infects humans). • Relationship, both in time and space, between the mosquito and the local cases of malaria	• Determination of blood digestion and ovarian development stage; • Demonstration of mosquito dissection and identification of salivary glands and ovaries • Calculation of transmission indices using results from field sampling
Sampling of larvae and adult mosquitoes	Larvae	Various mosquito vectors display different larval habitat preferences. Breeding sites can be very diverse, including ponds, lakes, swamps, marshes, rice fields, small rain pools, hoof-prints, car tires, tree holes and plant axils and edge of streams. It is important to know the breeding preferences of the local vectors of malaria in order to implement effective control measures. The reasons for doing larval sampling include: ▪ Determination of vector species present in the study area. ▪ Identification of preferred breeding sites for each species. ▪ Determination of the geographical distribution of vectors. ▪ Evaluation of anti-larval measures on larval density. ▪ Collect samples for rearing adults in the insectary.	• Collection of larvae and pupae using dippers, spoons, nets, and pipettes. • Differentiation of immature anophelines from culicines • Caluculation of densities
	Adults	Mosquito populations in any locality are made up of different species (individual or as specie/complexes). Species may exhibit varying behaviors which may impact the efficiency of the species as a vector. Variations in behavior may also occur within the same specie due to age or physiological states. Differences may include feeding behavior (indoor or outdoor) and choice of post-feeding resting surface for egg maturation (indoor or outdoor). Various sampling methods have been devised to take into account these differences within the vector populations.	• human landing catches, • pyrethrum spray sheet collection, • outdoor resting collection, • hand collection (aspiration) of indoor resting mosquitoes, • exit trap collection
Preparation, labeling and conservation of		Mosquito samples obtained from larval and adult surveys can be analyzed by a variety of standardized laboratory techniques to obtain important information of the biology of the mosquito	Participants will be trained on how samples are prepared, labeled

Topic	Purpose	Associated Activities
mosquito samples	species and their role as a malaria vectors. Mosquito samples are generally used for: i. Morphological identification of species and species complexes to assess mosquito vector populations. ii. Determination of the gonotrophic state (*i.e.* abdominal condition of females) to study resting behavior. ii. Determination of physiological age and insemination of females to study the mosquito population longevity and survival. v. Detection of malaria parasites in the mosquitoes to determine sporozoite rates. v. Determination of the origin of the blood meal to study host preferences. vi. Cytogenetic and molecular analyses for sibling species identification and to study genes of interest (*e.g.* insecticide resistance associated genes). Lab techniques (iv)-(vi) are considered advanced and participants will only be receiving introductory theoretical techniques.	and stored, including time of catch, location, and sample name; requirements for proper storage and transportation of samples Participants to conduct techniques (i)-(iii).
Basic essentials of rearing mosquitoes in the laboratory	An insectary is important to maintain an adequate supply of laboratory-reared mosquitoes (either fully susceptible an d local wild-caught species) for observation, identification and various assessments, such as susceptibility assays to insecticides, estimation of mosquito longevity and feeding habits. This unit will provide knowledge on: • The basic characteristics of an insectary. • Basic requirements for rearing larvae and adult anopheline mosquitoes in a laboratory environment.	Collecting wild-caught species at the larval stage and raising them through adult emergence. Will also include inducing oviposition in the laboratory.
WHO susceptibility testing and interpretation of results	Resistance of mosquito vectors to insecticides that are used in their control is a growing problem globally. Resistance development threatens the sustainability of malaria control programs. Understanding and knowing the level of susceptibility of local vectors enables the correct selection of pesticide-based intervention and managing local levels of resistance. Depending on country preference and history of use, either or both existing methodologies will be taught (i.e. WHO tube test to estimate susceptibility and CDC bottle assay)	• Perform WHO susceptibility tests • Calculate mortality • Abbott's Formula • Interpret results of assay
Cone bioassay tests of insecticide residual efficacy	This technique can be used to evaluate the residual efficacy of insecticide used for residual spraying operations. It can also be used to determine residual efficacy of an insecticide on long-lasting insecticidal nets	• Learn how to conduct cone assay on wall surfaces and LLINs • Learn how to use results to calculate knock-down

Topic	Purpose	Associated Activities
		rate/mortality

Outcomes: By the end of the training participants will:

- Be able to properly use the insectary and associated entomology laboratory that established in May 2012, by PMI with tech support through RTI/IVM.
- Be able to initiate credible and standardized entomological monitoring and reporting to inform vector control decisions.